July 5, 1938. R. L. BOURKE 2,122,677

INTERNAL COMBUSTION ENGINE

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Fig. 1.

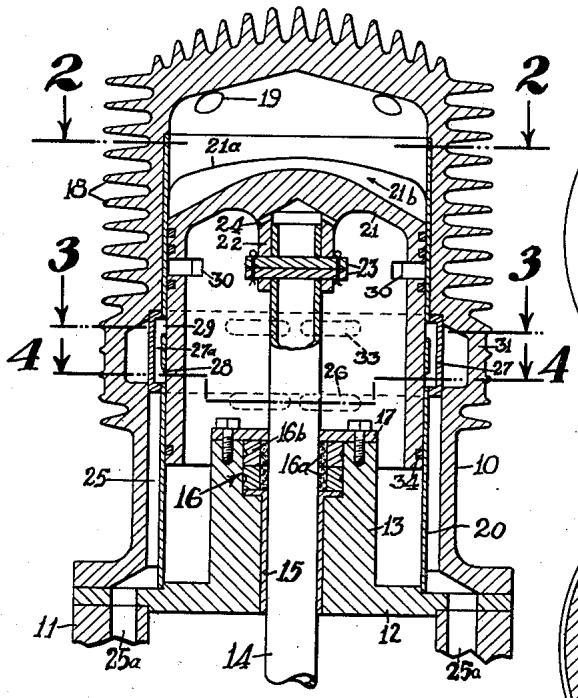

Fig. 2.

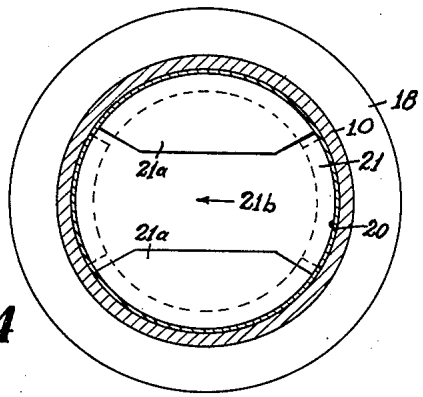

Fig. 3.

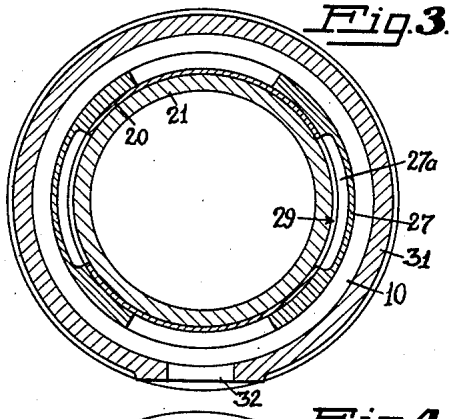

Fig. 5.

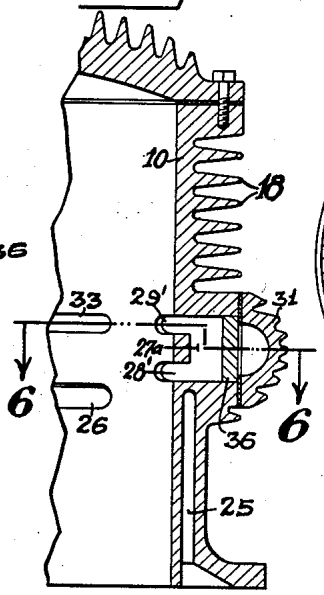

Fig. 6.

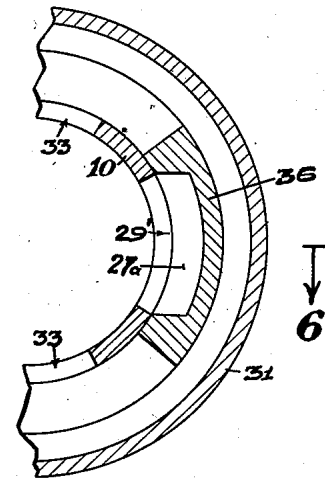

Fig. 4.

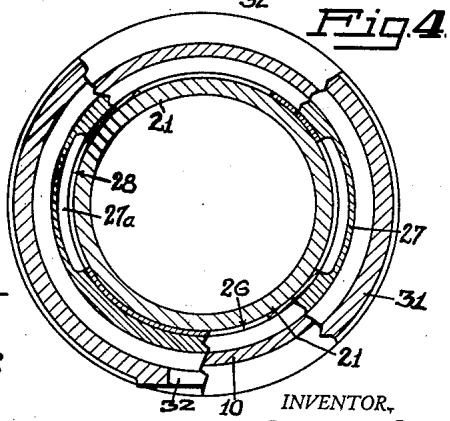

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Fig. 8.

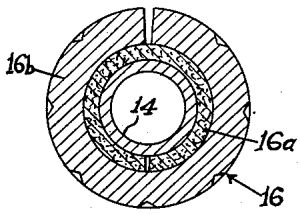


Fig. 9.

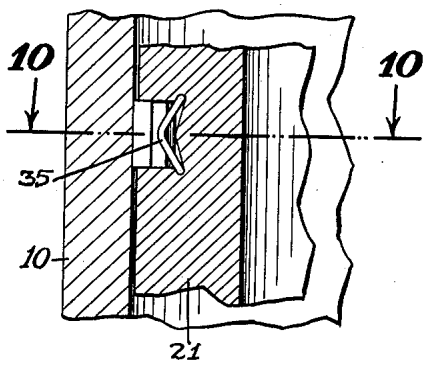


Fig. 7.

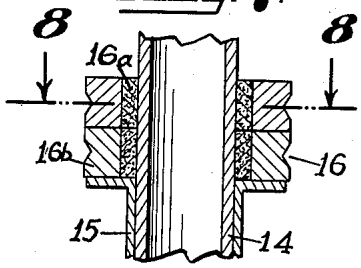


Fig. 10.

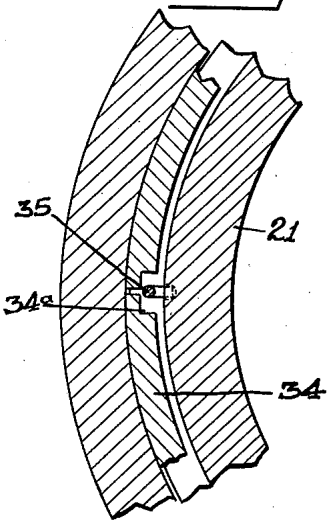
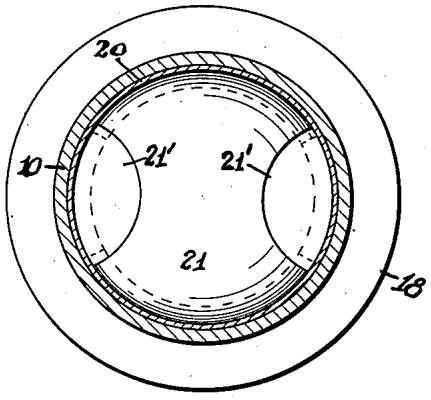


Fig. 11.



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Patented July 5, 1938

2,122,677

UNITED STATES PATENT OFFICE

2,122,677

INTERNAL COMBUSTION ENGINE

Russell L. Bourke, Petaluma, Calif.

Application May 12, 1936, Serial No. 79,287

2 Claims. (Cl. 123—74)

This invention relates to improvements in internal combustion engines and particularly to a novel cylinder and piston assembly.

An object of my invention is to provide an improved piston and cylinder assembly for internal combustion engines, embodying novel means for introducing a maximum charge of fuel into the combustion chamber, and for scavenging the gases of combustion therefrom after an explosion has occurred.

Another object of my invention is to provide a highly efficient and improved internal combustion engine having novel means associated with the pistons and cylinders for evenly distributing the heat generated with each explosion, whereby the cylinders and other parts of the engine are prevented from becoming distorted or overheated.

Other and further objects of my invention will be pointed out hereinafter, indicated in the appended claims, or obvious to one skilled in the art upon an understanding of the present disclosure. For the purposes of this application I have elected to show herein certain forms and details of piston and cylinder assemblies for internal combustion engines representative of my invention, and particularly well adapted for use with engines of the type disclosed in my copending application Serial No. 726,321, filed May 18, 1934; it is understood however, that the particular structures herein illustrated are not to be regarded as exhaustive of the variations of my invention nor are they to be given any interpretation such as might have the effect of limiting the claims, short of the true and most comprehensive scope of the invention in the art.

In the accompanying drawings:

Fig. 1 is a longitudinal central section of a cylinder and piston embodying the preferred form of my invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a longitudinal central section of a fragmentary part of a cylinder embodying a modified form of my invention;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is an enlarged vertical sectional view of a part of a connecting rod and the packing gland associated therewith;

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 7;

Fig. 9 is an enlarged vertical sectional view taken through a part of the piston, cylinder and piston ring, showing the means employed to prevent the rotation of the ring with respect to the piston;

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9; and

Fig. 11 is a sectional view corresponding to Fig. 2, showing a modified type of piston in top plan.

Referring to the drawings the numeral 10 designates one of several engine cylinders secured to a crank case 11 by any suitable means such as bolts. The cylinder is closed at its inwardly disposed end by an end plate 12 having in its center a tubular guiding member 13 which extends inwardly into the cylinder and serves as a guide for a tubular connecting rod 14. The rod slidably extends through a bushing 15 secured within the guiding member 13, and also through a packing gland 16 securely held in place at the end of the said member by a disc 17 bolted to the latter. As illustrated in Figs. 1, 7 and 8 the packing gland 16 comprises one or more split fiber rings 16*a* having one or more split metal rings 16*b* encircling the latter. The metal rings are preferably provided at their peripheries with grooves or peen marks, and the pressure exerted upon the fiber rings prevents the oil in the crankcase from escaping. The outer surface of the cylinder 10 has a number of cooling fins 18 projecting therefrom, and its dome shaped top end is provided with one or more spark plug openings 19.

The inside of the cylinder 10 is provided with a cylindrical liner 20 made preferably from an exceptionally hard metal. The liner is positioned with its lower or inwardly disposed end in firm engagement with the top surface of the plate 12. Mounted for reciprocating motion within the cylinder 10 is a piston 21 provided preferably with a dome shaped top end which is formed with oppositely disposed spaced raised members 21*a* that form an arched channel 21*b* extending centrally over the top surface of the piston's top. The top end of the piston is provided centrally with an inwardly disposed tubular boss 22 to which the outwardly disposed end of the connecting rod 14 is secured, as by a two-piece wrist pin 23. The wrist pin 23 is preferably made in two pieces which are connected together as by cotter pins in order that they may be conveniently placed in their properly assembled positions through certain ports in the piston. The boss 22 is provided with one or more holes 24 which for cooling purposes allows the free passage of the fuel into the tubular connecting rod. The inside of the connecting rod 14 being in communication with the area inside the piston, provides a larger space for the incoming fuel, thereby allowing a greater amount of fuel to be drawn into the cylinder during the outward stroke of the piston. The cylinder is divided by the piston into two chambers, the inner cham-

ber being the primary or pump chamber, and the outer chamber being a second compression and combustion chamber. The inner end of the cylinder 10 is sufficiently enlarged to provide an annular chamber 25 between the cylinder wall and the liner 20, the said chamber at its lower end being in communication with fuel intake channels 25a leading to a carburetor or other suitable fuel supply means. The liner 20 is provided with a number of fuel inlet ports 26 which are so located that they are in an open position when the piston 21 is at its extreme outward position. The inlet ports 26 are positioned so as to permit suitable charges of fuel to be readily drawn from the chamber 25 into the primary or inner chamber of the cylinder when the piston has moved to a position whereby the said ports are open. Encircling the liner 20 at points directly above the intake ports 26 is a ring-shaped member 27 having oppositely disposed grooves or channels 27a therein which form by-passes that permit charges of fuel passing outwardly through ports 28 in the liner 20 from the inner or primary chamber of the cylinder to be directed to ports 29 in said liner and thence into the outer or combustion chamber. When the piston 21 has reached its extreme inward position a pair of oppositely disposed outlet ports 30 in the said piston are brought into registry with the ports 28 of the liner 20, thereby allowing the compressed fuel in the cylinder's inner or pump chamber to proceed into the channel 27a of the ring shaped member 27, and thence through the ports 29 in the said liner and into the cylinder's outer or combustion chamber. When the piston is in its extreme inwardly disposed position the top of the latter clears the ports 29 in the liner 20, thereby allowing the free by-passing of the fuel from the inner chamber of the cylinder to the outer or combustion chamber. Extending circumferentially around the cylinder 10 at points adjacent but spaced from the ring shaped member 27 is an exhaust manifold 31 which has a gas outlet port 32. The liner 20 is provided with a plurality of exhaust ports 33 which empty into the channel defined by the exhaust manifold 31. The exhaust ports 33 are so located that they are uncovered just prior to the piston 21 having reached its extreme inward position. The ends of the arched channel 21b located at the top of the piston 21 are positioned in registry with the ports 29 of the liner 20 when the said piston is in its extreme inward position, thereby causing the incoming fuel to be concentrated in the area of the combustion chamber within and above the said arched channel. The spark plug openings 19 at the top of the cylinder are so positioned that the spark plugs ordinarily located therein, are directly in line with the channel 21b, thereby bringing the compressed and concentrated fuel into close communication with the spark plugs when the explosion is to occur.

The piston 21 is provided with a number of piston rings 34 the adjacent ends of which are provided with grooves 34a that accommodate a spring member 35, the ends of which are normally lodged in suitable notches provided in the wall of the said piston (Figs. 9 and 10). The spring member 35 being secured in a fixed position to the piston, and being located between the ends of the piston ring 34, serves to prevent the latter from rotating with respect to the piston.

As illustrated in Fig. 11, the piston 21 may be formed with a spherical or dome-shaped top end, in which oppositely disposed depression areas 21' are located near its periphery. In ordinary practice the depression areas 21' form pockets in which the fuel is concentrated just prior to the explosion, and the spark plugs are positioned directly above the said areas.

In the form illustrated in Figs. 5 and 6 in which the liner 20 may be eliminated, the cylinder 10 may be provided with the oppositely disposed by-pass ports 28' and 29', with the chamber 25, with the intake ports 26 and with the exhaust ports 33. In this form the exhaust manifold 31 is not necessarily an integral part of the cylinder but may be a separate member which is suitably secured as by bolts or other means to the said cylinder. A partition member 36 separates the channel in the exhaust manifold from the by-pass channel 27a. In ordinary practice the connecting rod 14 is suitably connected to a crankshaft or other means to be actuated.

Having described my invention what I claim is:

1. In an engine, a cylinder having fuel intake and exhaust ports in its side walls, an exhaust manifold positioned around the cylinder and the exhaust ports, the said cylinder having both of its ends closed, and a hollow piston in the cylinder having its inwardly disposed end open, the said piston dividing the interior of the cylinder into two chambers, a pair of spaced by-pass ports positioned in the wall of the cylinder at points inwardly of the exhaust manifold but in close proximity thereto, the said by-pass ports being connected by channel means permitting the passage of fuel from one of said by-pass ports to the other, and fuel outlet ports in the piston which are adapted to register with certain of the by-pass ports of the cylinder when the piston is in its extreme inwardly disposed position, the other of the by-pass ports being opened by the piston when it is in said position, whereby fuel from one of the chambers of the cylinder may proceed through the by-pass means into the other chamber.

2. In an engine, a cylinder having its both ends closed, and provided with fuel intake and exhaust means, a cylindrical liner for the cylinder having fuel intake ports and exhaust ports therein, a hollow piston in the cylinder having its inwardly disposed end open, the said piston dividing the cylinder into two chambers, a pair of spaced by-pass openings in the liner connected by channel means, a by-pass opening in the piston which is adapted to register with one of the by-pass openings in the liner when the said piston is in its extreme inward position, the other of the by-pass openings in the liner being opened when the piston is in said position, whereby fuel may proceed through the by-pass means from one of the cylinder's chambers to the other, and an exhaust manifold associated with the exhaust means, the said manifold extending around the cylinder directly adjacent the fuel by-pass means, whereby the fuel proceeding from one by-pass opening to another may be preheated by the gases of combustion passing through the exhaust manifold.

RUSSELL L. BOURKE.